ELECTRICAL MEASURING INSTRUMENTS

GENERAL ELECTRIC COMPANY

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GENERAL ELECTRIC COMPANY
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THE operation of modern high efficiency electrical machinery would be impracticable and the benefits of its development would be lost if electrical measuring instruments of equally perfected designs were not available. Defective instruments, especially on a switchboard, may result not only in inefficient and unsatisfactory operation of the entire system, but also in the destruction or impairment of the generating and distributing apparatus. The fundamental aim of all improvements characterizing the development of the General Electric Company's indicating instruments has been to secure not only high initial accuracy, but also permanent accuracy. The instruments described on the following pages are offered to the trade with the assurance that they possess the following essential characteristics developed to the highest degree consistent with the conditions of practical use:

1. Accuracy;
2. Permanence;
3. Freedom from liability of disturbance by local influences;
4. An indicating needle which comes to rest with a minimum of oscillation;
5. Convenience and simplicity of installation;
6. Structural simplicity, rendering the necessity of repairs unlikely but the execution of repairs simple if necessary;
7. Legibility of scale and distribution of divisions to give the widest deflections in that portion of the scale most commonly used;
8. Appearance.

These requirements should all be considered in purchasing indicating instruments, and each should be allowed its proper importance in determining what type of instrument is best adapted to any specific work.

For convenience, electrical measuring instruments are classified in this pamphlet as follows:

PORTABLE INSTRUMENTS

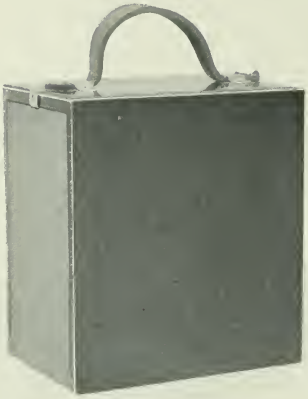
SWITCHBOARD INSTRUMENTS

For Continuous Current Switchboards,

For Alternating Current Switchboards,

Current and Potential Transformers for use with Switchboard Instruments.

PORTABLE INSTRUMENTS



CARRYING CASE FOR PORTABLE INSTRUMENTS

PORTABLE AMMETERS AND VOLTMETERS.

PORTABLE instruments of the Inclined Coil Type are accurate and permanent for alternating currents of any frequency and may also be used with good results for direct current measurements. The simplicity of the mechanism permits of substantial construction which will resist the shocks and rough usage incident to transportation.

With the exception of the pocket sizes, they are provided with wood carrying cases.

Portable Voltmeters are key instruments, and should not remain continuously in circuit.

The full size scales of portable instruments on pages 16 to 20 show the calibrations of the various capacities.

PORTABLE VOLTMETER

PORTABLE VOLTMETER—COVER REMOVED

PORTABLE AMMETERS AND VOLTMETERS.

AMMETERS.				VOLTMETERS.			
CAT. NO.	CAPACITY IN AMPERES.	APPROX. WEIGHT WITH CARRYING CASE. LBS.	LIST PRICE.	CAT. NO.	CAPACITY IN VOLTS.	APPROX. WEIGHT WITH CARRYING CASE. LBS.	LIST PRICE.
6461	2	4½	$40.00	3335	65	4½	$50.00
6456	10	4½	40.00	3336	130	4½	50.00
3332	15	4½	40.00	3344	300	4½	50.00
6457	25	4½	40.00	3337	600	4½	50.00
6458	50	4½	40.00				
6459	100	4½	50.00				
6460	200	4¾	50.00				

PORTABLE INDICATING WATTMETERS.

INCLINED Coil Indicating Wattmeters will be found particularly useful for incandescent lamp, transformer, and alternating current arc lamp measurements. They are accurate even upon circuits carrying an inductive load such as motors or economy coils. All sizes may be used at any voltage up to 150 volts, and the permissible maximum current is marked upon each instrument. Indicating Wattmeters with special resistances for higher voltages can be supplied on special order. The 150 watt instrument is useful for measuring iron losses of transformers and for incandescent lamp work. The Indicating Wattmeter gives accurate results for direct current measurements, provided two observations are taken for each reading. The connections of the instrument, both current and voltage, must in this case be reversed between the observations, and the mean of the two observations taken as the correct indication.

A portable wattmeter with special features to facilitate lamp testing has recently been designed. It is known as the Lamp Inspectors' Indicating Wattmeter and is described on the following pages.

PORTABLE INDICATING WATTMETER

PORTABLE INDICATING WATTMETERS.

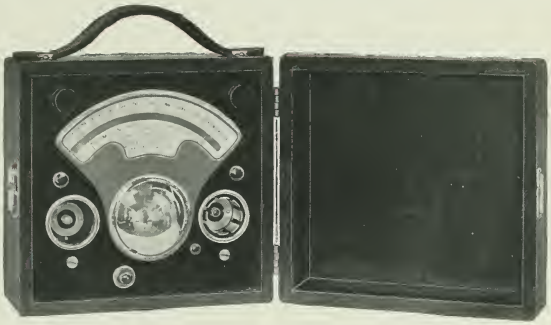
CAT. NO.	CAPACITY IN WATTS.	APPROX. WEIGHT WITH CARRYING CASE. LBS.	LIST PRICE.
7986	150	4¼	$75.00
7981	300	4½	75.00
7982	1500	4¼	75.00
7983	2500	4¼	75.00
8092	5000	8½	110.00
8093	10000	8½	115.00
8094	15000	8½	120.00
8095	20000	8½	125.00

Portable wattmeters of 5000 watts and over are on larger bases and under larger covers than those of lower ratings.

LAMP INSPECTORS' INDICATING WATTMETER.

THE successful operation of an incandescent lighting system depends largely upon the use of lamps of the proper efficiency. To secure the most satisfactory service and highest economy, the efficiency of the lamps should be as high as the fluctuations of voltage on the circuits will permit. The selection of lamps for a particular installation should, therefore, be made with regard to the regulation obtained with the transformers in use. Efficiency is also the true basis for renewal of lamps, for it is manifestly uneconomical to continue a lamp in service when its candle-power has so deteriorated that the watts it wastes cost more than a new lamp.

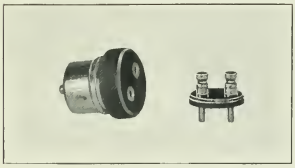
In connection with a photometer, a portable instrument to determine accurately and rapidly the watts per candle required by a lamp, is of great value in selecting new lamps and in testing lamps in service. The photometer measures the candle-power of the lamp and the wattmeter the total watts consumed; the watts per candle are then readily determined. Lamps manufactured by the General Electric Company are so carefully photometered that the candle-power before the lamps are burned may be assumed to be correct and the watts per candle determined by the wattmeter without a photometer, but in testing miscellaneous lamps, measurements of candle-power are necessary.



LAMP INSPECTOR'S INDICATING WATTMETER

To meet an increasing demand, the General Electric Company has recently designed and introduced the Lamp Inspectors' Indicating Wattmeter. All of the well known merits of the Thomson Inclined Coil instruments are included in the new wattmeter and the workmanship is of the highest grade. The present design was adopted after numerous experiments to determine the most advan-

tageous arrangement to facilitate *rapid* testing of lamps. On account of the rapidity with which readings may be made, the indicating wattmeter in connection with a photometer will also be found invaluable for testing lamps in barrel lots. The wattmeter will accurately indicate the energy used by small fan motors and is therefore particularly



SECONDARY ATTACHING PLUG

useful in comparing, for a customer's benefit, the relative amount of energy required by a fan motor and an ordinary incandescent lamp. By supplying the secondary of a transformer with current, its core loss may be easily determined by the indicating wattmeter.

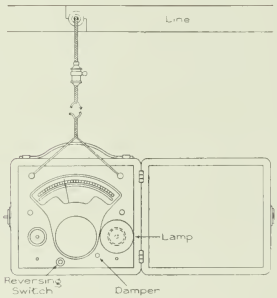
The accompanying illustrations show the unique construction which permits rapid connection. The wattmeter is supplied with two special plugs, an Edison with T-H adapter and a Westinghouse, thus providing ready means for connection to the three forms of sockets most generally in use.

The lamp to be tested is inserted in one of the receptacles *in the base of the instrument*, and the proper plug is placed in any convenient socket. Lead wires are provided suitably tipped at one end for insertion in the plugs and at the other for connection to the binding posts of the instrument.

A small secondary plug arranged to fit the regular plugs and provided with two small binding posts is also supplied with every instrument. With this convenient device the power required by small motors or other apparatus may be conveniently measured.

The capacity of the indicating wattmeter is 150 watts. Lamps of any candle-power up to 32 and of any voltage up to 150 may be tested, as may also any device, the consumption of energy in which is not over 150 watts at any voltage not exceeding 150 and current not exceeding 2 amperes.

The fact that the instrument is equally well adapted for use on either



METHOD OF CONNECTING

direct or alternating currents, necessitates the use of only one instrument in stations using both systems.

On direct current circuits, reverse readings should be taken to eliminate the possibility of any slight error which may be introduced in all instruments of this class by the presence of local fields. For convenience a special reversing button is provided to reverse the current

in the instrument and lamp without the usual inconvenience of reversing the lead terminals.

When reversed readings are made the mean of the two is, of course, taken as the final reading.

Another advantageous feature of the instrument is the damping device. A button is provided which releases the needle or pointer from the damping brake *only* when depressed. When the button is released the needle is held at the point of the last indication; therefore if the current is turned off and then on again, or reversed, the necessity of waiting for the pointer to swing from zero to a state of rest is avoided and very rapid readings may be taken.

The instrument is mounted in a finely polished carrying case, with snap lock and key. It is of very light weight and exceedingly compact, the external dimensions being $7\frac{3}{8}''$ x $7\frac{3}{8}''$ x $4\frac{1}{2}''$.

The terminals, and reversing and damping buttons are mounted on a vulcanite baseboard above which the metal cover over the graduated dial slightly projects.

All parts are finished in black oxide.

LAMP INSPECTORS' INDICATING WATTMETER.

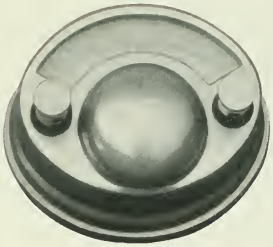
CAT. NO.	CAPACITY IN WATTS.	WEIGHT WITH CARRYING CASE. LBS.	LIST PRICE.
7987	150	$5\frac{1}{2}$	$100.00

POCKET AMMETERS AND VOLTMETERS.

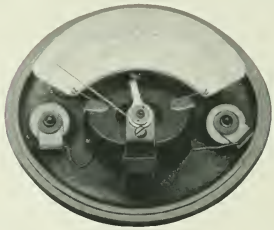
THE compact mechanism of the inclined coil type of instrument permits the construction of voltmeters and ammeters so small that they may be carried in the side pocket of a coat. Their construction is especially strong, so that they will withstand comparatively rough usage without loss of accuracy.

Special attention is called to the great length of the scale as compared with the size of the instrument. These instruments may be used upon either direct or alternating current circuits.

The ammeter is well adapted for small isolated plants, and when supplied for such installations it is specially calibrated and furnished with lugs for securing to switchboards or bank-boards.



POCKET AMMETER



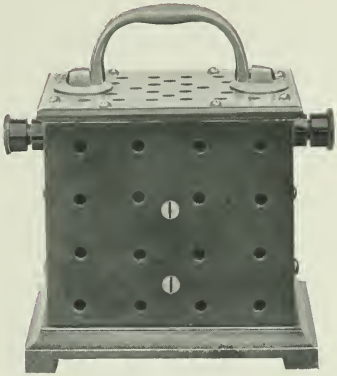
POCKET AMMETER—COVER REMOVED

POCKET AMMETERS AND VOLTMETERS.

AMMETERS.				VOLTMETERS.			
CAT. NO.	CAPACITY IN AMPERES.	WEIGHT COMPLETE. OZ.	LIST PRICE.	CAT. NO.	CAPACITY IN VOLTS.	WEIGHT COMPLETE. OZ.	LIST PRICE.
7975	2	16	$25.00	7984	75	15	$30.00
7976	10	16	25.00	7985	150	15	30.00
7977	25	17	25.00				

Pocket Ammeter and Pocket Voltmeter, List Price per pair, $50.00.

MULTIPLIERS FOR PORTABLE VOLTMETERS.



SCALE DOUBLING MULTIPLIER

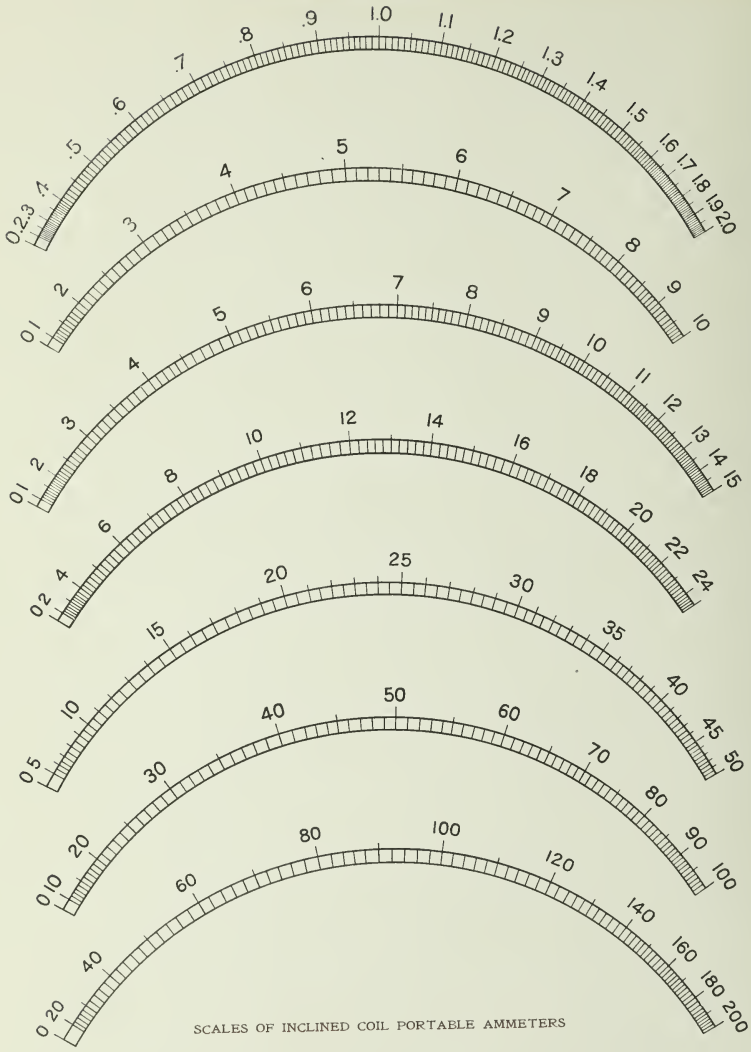
IT is frequently found desirable to make measurements higher than the usual scale limit of the instrument. For such measurements the General Electric Company manufactures a line of Scale Doubling Multipliers for use in connection with its Portable Inclined Coil Voltmeters and Portable Indicating Wattmeters. The standard multipliers are manufactured only with a 2 to 1 ratio. Multipliers with special ratios can be specially manufactured when required. The factory serial number of the instrument with which the multiplier is to be used must always be given when ordering, as multipliers are not interchangeable.

MULTIPLIERS FOR INCLINED COIL PORTABLE VOLTMETERS.

CAPACITY OF VOLTMETER IN VOLTS.	WEIGHT COMPLETE. LBS.	LIST PRICE.
65	$1\frac{1}{4}$	$20.00
130	$1\frac{1}{4}$	20.00
300	$1\frac{1}{4}$	25.00
600	$1\frac{1}{4}$	25.00

MULTIPLIER FOR PORTABLE WATTMETER.

CAPACITY OF WATTMETER IN VOLTS.	WEIGHT COMPLETE LBS.	LIST PRICE.
150	$1\frac{1}{4}$	$22.00



SCALES OF INCLINED COIL PORTABLE AMMETERS